National Institute of Environmental Health Sciences

Modeling the epidemiological history of plague in Central Asia: Palaeoclimatic forcing on a disease system over the past millennium

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Abstract:

BACKGROUND: Human cases of plague (Yersinia pestis) infection originate, ultimately, in the bacterium's wildlife host populations. The epidemiological dynamics of the wildlife reservoir therefore determine the abundance, distribution and evolution of the pathogen, which in turn shape the frequency, distribution and virulence of human cases. Earlier studies have shown clear evidence of climatic forcing on contemporary plague abundance in rodents and humans. RESULTS: We find that high-resolution palaeoclimatic indices correlate with plague prevalence and population density in a major plague host species, the great gerbil (Rhombomys opimus), over 1949-1995. Climate-driven models trained on these data predict independent data on human plague cases in early 20th-century Kazakhstan from 1904-1948, suggesting a consistent impact of climate on large-scale wildlife reservoir dynamics influencing human epidemics. Extending the models further back in time, we also find correspondence between their predictions and qualitative records of plague epidemics over the past 1500 years. CONCLUSIONS: Central Asian climate fluctuations appear to have had significant influences on regional human plague frequency in the first part of the 20th century, and probably over the past 1500 years. This first attempt at ecoepidemiological reconstruction of historical disease activity may shed some light on how long-term plague epidemiology interacts with human activity. As plague activity in Central Asia seems to have followed climate fluctuations over the past centuries, we may expect global warming to have an impact upon future plague epidemiology, probably sustaining or increasing plague activity in the region, at least in the rodent reservoirs, in the coming decades.See commentary: http://www.biomedcentral.com/1741-7007/8/108.

Source: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2944127

Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature, Other Exposure

Temperature: Fluctuations

Other Exposure: monsoon strength; glaciological accumulation series

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location: ☑

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Region

Other European Region: central europe

Health Impact: ☑

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Flea-borne Disease

Flea-borne Disease: Plague

Mitigation/Adaptation: ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology: ☑

type of model used or methodology development is a focus of resource

Methodology, Outcome Change Prediction

Resource Type: ☑

format or standard characteristic of resource

Research Article, Research Article

Timescale: ☑

time period studied

Historical

Vulnerability/Impact Assessment: ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content